

**REMARKS**

Claims 1 to 8 are pending. Claims 1 and 4 are amended. Support for the amendments appear in the specification, e.g., at p. 5, lines 15-20 and p. 13, lines 1-8.

**§ 102 Rejections**

Claims 1 and 4 were rejected under 35 U.S.C. 102(b) as being anticipated by Gregor et al. (US 5,354,955) (referred to hereinafter as "Gregor").

The Office Action essentially states that:

Regarding claim 1, Gregor et al, discloses in e.g., Fig. 1 a laminated flip-chip interconnect package (the package in Fig. 1) comprising

- a substrate (12; column 3, line 7) having a chip attach surface (the top surface of the substrate 12 where the chip 14 is attached) and an opposing board attach surface (the bottom surface of the substrate 12) that define contact pads (the pads under the solder ball 20 and pads on the top surface of the substrate 12) for attachment to corresponding pads on the chip (14; column 3, line 8) and board (10; column 3, line 5),
- wherein the board attach surface (at the bottom surface of the substrate 12) comprises
  - o a pattern of contact pads (the pads under the solder ball 20) opposite and "adjacent" a chip attach location (the area on the substrate 12 where the chip 14 is attached) on the chip attach surface except at least one unpatterned solid plane area (at the solid and non-pad areas on the back surface of the element 12 which are directly opposite areas of the element 25) of the board attach surface (see e.g., Fig. 1),
  - o said unpatterned solid plane area (at the solid and non-pad areas on the back surface of the element 12 which are directly opposite areas of the element 25) being "adjacent" to a corner of chip attach location (see e.g., Fig. 1), and
- said board attach surface (the surface that has the elements 120) comprising a dielectric material (the lowermost dielectric layer in the element 12).

Regarding claim 4, Gregor et al, discloses in e.g., Fig. 1 a laminated flip-chip interconnect package (the package in Fig. 1) comprising

- a substrate (12) having a chip attach surface (the top surface of the substrate 12 where the chip 14 is attached) and an opposing board attach surface (the bottom surface of the substrate 12) that defines a pattern of contact pads (the pads between the solder ball 20 and the substrate 12) for attachment to corresponding pads on the chip (14) and board (10),
- wherein the board attach surface (at the bottom surface of the substrate 12) comprises
  - o at least one unpatterned solid plane area (at the solid and non-pad areas on the back surface of the element 12 which are directly opposite areas of the element 25),
  - o said unpatterned area (at the solid and non-pad areas on the back surface of the element 12 which are directly opposite areas of the element 25) being opposite a chip attach surface region adjacent at least one corner of a chip attach location (see e.g., Fig. 1), and
- said board attach surface comprising a metal (At the year 1994, all wirings or circuits or pads materials includes metal materials, i.e., copper or aluminum, etc. Thus, Gregor et al. anticipates this limitation.).

Applicants respectfully submit that according to MPEP 2131 "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." (citing *Verdegall Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987)).

Applicants have amended claims 1 and 4 to include the limitation that the unpatterned solid plane area is at least the size of a region in which strain due to thermal cycling from 125°C to -55°C is greater than the strain at which cracking will occur in the absence of the unpatterned solid plane area. Gregor does not disclose such a limitation. Accordingly, the reference does not describe every element of the claimed invention.

For these reasons, Applicant(s) submit that the cited reference will not support a 102(b) rejection of the claims and request that the rejection be withdrawn.

### **§ 103 Rejections**

Claims 2, 3 and 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gregor et al. in view of Lau (U.S. 6,075,710).

The Office Action essentially states:

Regarding claims 2, 3 and 5 - 7, while Gregor et al. discloses the use of the dielectric and metal materials on the board attach surface of the substrate, Gregor et al. does not disclose a solder mask on the dielectric material (claim 2) and metal (claim 6), the solder mask being a polyimide (claims 3 and 7) and the metal material being copper (claim 5). Lau teaches in e.g., Fig. 4A a solder mask (155 or 235; column 5, lines 65 - 67) on a dielectric material (the dielectric material in the bottom of the substrate; column 5, lines 19 and 20) and metal (Cu 130; column 5, lines 38 - 40) and the solder mask being a polyimide (column 7, line 39). Since the element 235 of Lau works as a mask layer for the solder pastes 245, the element 235 reads as a solder mask. Since the solder mask 235 is made by a polyimide material, Lau discloses a polyimide material for the solder mask. It would have been obvious to one of ordinary skill in the art at the time when the invention was made to apply the solder mask (e.g., polyimide) of Lau to cover the dielectric material and metal on the unpatterned solid plane area of Gregor et al., as taught by Lau to provide finer pitches between the external connections (column 6, lines 4 - 6).

Regarding claim 8, Gregor et al., as modified, discloses a solder mask (155 of Lau) having a plurality of openings (the openings for the pads 130 of Lau) defining ball grid array pads (see e.g., Fig. 3C).

Applicants respectfully submit that according to MPEP 2142, to establish a case of *prima facie* obviousness, three basic criteria must be met: 1) there must be some suggestion or motivation, either in the references or generally known to one skilled in the art, to modify or combine reference teachings, 2) there must be reasonable expectation of success, and 3) the prior art references must teach or suggest all the claim limitations. The ability to modify the method of the references is not sufficient. The reference(s) must provide a motivation or reason for making the changes. *Ex parte Chicago Rawhide Manufacturing Co.*, 226 USPQ 438 (PTO Bd. App. 1984).

Applicants respectfully submit that the references cannot support a case of *prima facie* obviousness as to the claims because, among other possible reasons, the cited references do not

provide a motivation or suggestion for an unpatterned solid plane area is at least the size of a region in which strain due to thermal cycling from 125°C to -55°C is greater than the strain at which cracking will occur in the absence of the unpatterned solid plane area because Gregor addresses the issue of facilitating engineering changes on the chip surface of a chip interposer by using jumper wires and Lau addresses providing a surface-mount compatible land-grid array chip scale package for packaging a solder-bumped flip chip wherein solder bumps of low melting point are employed. Neither reference contemplates or addresses the issue of cracks in interconnect modules. Furthermore, there could be no reasonable expectation of success because neither reference teaches the how to prevent cracks in interconnect modules. In addition, these references do not disclose all the elements of the present invention because they do not disclose the element added to amended claims 1 and 4.

For these reasons, Applicant(s) submit that the cited references will not support a 103(a) rejection of the claims and request that the rejection be withdrawn.

In addition to the foregoing arguments, Applicant(s) submit that a dependent claim should be considered allowable when its parent claim is allowed. *In re McCarn*, 101 USPQ 411 (CCPA 1954). Accordingly, provided the independent claims are allowed, all claims depending therefrom should also be allowed.

Based on the foregoing, it is submitted that the application is in condition for allowance. Withdrawal of the rejections under 35 U.S.C. 102(b) and 103(a) is requested. Examination and reconsideration of the claims are requested. Allowance of the claims at an early date is solicited.

The Examiner is invited to contact Applicant(s)' attorney if the Examiner believes any remaining questions or issues could be resolved.

Respectfully submitted,

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Date

By: Melanie Gover  
Melanie G. Gover, Reg. No.: 41,793  
Telephone No.: 512-984-4308

Office of Intellectual Property Counsel  
3M Innovative Properties Company  
Facsimile No.: 651-736-3833